JMC Environmental Consultants, Inc.

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March 18, 2016

Jay Nickerson, Case Manager
Bureau of Case Management, Site Remediation Program
New Jersey Department of Environmental Protection
Mail Code 401-05F
401 East State Street
P.O. Box 420
Trenton, New Jersey 08625-0420

Re: ***RAW Addendum***
Arsynco, Inc.
Foot of 13th Street
Carlstadt, Bergen County
SRP PI# 024248
ISRA Case # 93024

Dear Mr. Nickerson:

The following provides an addendum to the December 2003 Remedial Action Workplan (RAW) for the above-referenced facility. The December 2003 RAW was partially approved by the Department in May 2006. The partial RAW approval included NJDEP approval of an asphalt cap remedy (with institutional controls) across the majority of Tract 1 (with the exception of the TSCA disposal areas, which are capped separately). The asphalt cap was proposed/approved to address the following contaminants that will remain on Tract 1 of the site at levels above the NRDCSCC:

- the historic fill contamination,
- fill soils with PCB levels <50 ppm that will remain across areas of Tract 1 (including the former building slabs and foundations),
- residual levels of contamination that may remain above the NRDCSCC following excavation and disposal of soils within the area of process-type waste fill material in the southeast part of Tract 1 and in other areas of Tract 1,
- potential levels of VOCs that might remain above NRDCSCC following active treatment in the area of the AS/SVE system on Tract 1 (and that are not adversely impacting groundwater).

This RAW addendum is being submitted in relation to constructing a permeable cap in place of the previously approved asphalt cap across the majority of Tract 1 (excluding the TSCA disposal area). The proposed permeable cap would be 2 feet thick and consist of certified clean fill covered by up to 6 inches of either certified clean top soil with vegetation cover or gravel. A permeable separation/demarcation

layer to provide a visible indicator of the bottom of the cap. The cap would be compacted to reduce settling, and the top soil cover areas would be vegetated (seeded for common grasses typical to region of site that are low maintenance and draught resistant) for further stability and control of erosion. The top soil and vegetation cover would be used in most areas, but a surface gravel layer would be required in certain areas of the site (e.g., site ingress/egress points, site access roads, parking areas, etc.). Tract 1 of the site is essentially flat, and the final grading with the permeable cap will have no slopes steeper than 3:1, which is preferential for erosion control. As required, routine inspections will be conducted, and general maintenance and erosion control will be conducted (O&M activities) under a Soil Remediation Permit. Proposed, long term engineering controls for Tract 1 also include maintaining perimeter fencing to prevent unauthorized entry onto the site, and future use of the site will be limited to non-residential. The permeable soil/vegetation cap will mitigate exposure to potential receptors and will be protective of human health and the environment. The extent of the proposed permeable soil/vegetation cap is shown on Figure 1 (attached).

The vast majority of the Tract 1 contaminants that will remain under the cap at levels above the NRDCSCC include PCBs, PAHs and metals. Each of these contaminants are typically very stable and largely immobile compounds that are normally insoluble in water. PCBs and PAHs in soil have been shown to be immobile at this site and have not been identified in groundwater. Since the majority of Tract 1 is currently covered with a permeable soil surface, these contaminants would continue to be immobile as a result of installing a permeable cap. Some of the higher levels of metals in site soils will be excavated and disposed off site as part of the PCB soil remediation program. However, other metals will remain in site soils beneath the cap. Some of these metals have been detected in groundwater beneath the site (most commonly arsenic and lead), and these metals are the result of a regional groundwater quality issue and/or the presence of historic fill material on the site and throughout the region. Neither an asphalt cap nor a permeable soil/vegetation cap would change or otherwise impact the presence or mobility of these metals in groundwater, and a capillary break is not necessary with the proposed cap.

The receptor evaluation process has been ongoing at the site and has addressed land use, groundwater, vapor intrusion and ecological concerns. No land use, groundwater or vapor intrusion concerns have been documented in connection with the site. The Baseline Ecological Evaluation (BEE) conducted at the site looked at the potential for contaminants in soil to reach a receptor, and the results of the BEE suggested a potential for impacts to terrestrial ecological receptors from exposure to certain VOCs, SVOCs, PCBs, and metals in Tract 1 soils. However, it was determined during the BEE that once the proposed remedial measures for Tract 1 were implemented, the migration pathway that exists for these soils would be eliminated. The proposed remedial measures for Tract 1 contemplated during the BEE included:

1) the active treatment of VOCs in soil via an AS/SVE system;

2) the excavation and off site disposal of impacted soils with PCB concentrations >499 ppm;

3) the excavation, consolidation and capping (TSCA cap) of soils with PCB concentrations between 50 ppm and 499 ppm;

4) the excavation and off site disposal of soils with higher levels of other contaminants (VOCs, SVOCs, metals, phenols and TPH) within the area of process-type waste fill material that will be remediated along with the soils containing PCBs >499 ppm;

5) the installation of the previously proposed asphalt cap to address historic fill material contaminants and residual levels of potentially site-related contaminants (PCBs <50 ppm, certain metals, SVOCs, VOCs) that would remain following the active remedial measures noted above; and,

6) implementation of additional engineering controls (fencing) and appropriate institutional controls (deed notice), along with the required long term monitoring and maintenance activities (O&M activities) under a Soil Remediation Permit.

Each of the remedial measures listed above will still be implemented with the exception of item #5, where the asphalt cap would be replaced by the proposed 2 foot thick permeable soil/vegetation cap. The proposed permeable soil/vegetation cap would also satisfactorily address the potential migration pathways noted in the BEE.

In addition to the BEE, Arsynco previously submitted a baseline human health risk assessment for PCBs in accordance with the EPA guidance provided for the site. The results of the risk assessment demonstrated that there was no unreasonable risk posed by PCBs in site soils following implementation of a *"baseline"* remedy scenario that was specified by EPA, and the results were well within acceptable regulatory risk ranges. The *"baseline"* remedy specified by EPA was a scenario where material with PCB concentrations >499 ppm would be excavated and disposed off-site, and remaining material with concentrations of PCBs from 50 ppm to 499 ppm would be consolidation into one area of the site but not capped (i.e., left exposed). This "baseline" scenario was found to be within acceptable regulatory risk ranges. Therefore, the installation of a 2 foot thick clean soil/vegetation cap to prevent direct exposure to the PCB soils that would remain on Tract 1 (in addition to the cap controls in the TSCA disposal areas) is a much more conservative approach that would result in even further reduced risk.

The primary exposure routes for the contaminants of concern that will remain below the cap are dermal contact, ingestion and inhalation, and the proposed permeable soil/vegetation cap will prevent direct exposure to the soil and eliminate these exposure routes. As a result, a 2 foot thick clean soil and vegetation cap will be at least as protective of receptors as the previously proposed asphalt cap.

In fact, the clean soil/vegetation cap is preferred at this site for the following reasons:

a. The site is located within a flood zone, and raising the elevation of Tract 1 of the site by using a 2 foot clean soil and vegetation cap (as opposed to 5 inches with an asphalt cap), along with implementation of a proper monitoring and maintenance program to reduce and control erosion and maintain cap effectiveness, will better protect the site from the impacts of potential flooding (i.e., the increase in surface elevation with a thicker cap system would subject the site to less flooding events).

b. The shallow groundwater table at the site is within 1 foot of the ground surface, and often shallower in some areas. Adding a thicker clean soil and vegetation cap will create an additional vadose zone to act as a buffer to groundwater. The majority of the contaminants that will remain in soils under the 2 foot cap are not soluble in water (PCBs and PAHs), so upward movement of these compounds in soil moisture is not a concern with a permeable cap scenario.

c. Unlike an asphalt cap, a permeable soil cap would not significantly reduce infiltration and depress the water table or cause a change in groundwater flow conditions.

the 2 foot cap are not soluble in water (PCBs and PAHs), so upward movement of these compounds in soil moisture is not a concern with a permeable cap scenario.

c. Unlike an asphalt cap, a permeable soil cap would not significantly reduce infiltration and depress the water table or cause a change in groundwater flow conditions.

d. A permeable cap would allow for continued natural remediation and biodegradation of VOCs in shallow groundwater by allowing more fresh oxygenated water to percolate through the site.

e. Unlike an asphalt cap, a permeable cap would not greatly alter the water balance for the site. This is important at this site due to the presence of adjacent wetland areas.

f. Future site development will require that future site structures be at least one foot above the 100 year base flood elevation established by FEMA. This would require that virtually the entire area of Tract 1 be raised by as much as 5 feet in order to accommodate many future use scenarios for the property. If an asphalt cap were installed at this time, under many future use scenarios it would have to be entirely removed and replaced with several feet of soil to raise the site topography when the site was to be reused/redeveloped. The 2 foot permeable clean soil and vegetation cap would bring the site closer to the new FEMA base flood elevation standards and would be much more attractive to potential developers, while still being protective of human health and the environment.

g. An increase is surface water runoff is a significant concern in the region of the Arsynco site. The site currently contains mostly permeable ground surfaces, and an asphalt cap across the majority of Tract 1 would create significant, additional surface runoff that could adversely impact surrounding properties. A 2 foot clean soil and vegetation cap would eliminate concerns associated with additional runoff and impacts to surrounding properties. Arsynco conducted an evaluation of stormwater runoff under both existing site conditions and proposed post-construction conditions following installation of a 2 foot permeable soil and vegetation cap. Based on the hydrologic models and analysis, the proposed permeable cap actually results in a slight decrease in stormwater runoff (see Attachment A). This is much more advantageous to the site area, which already experiences regional flooding.

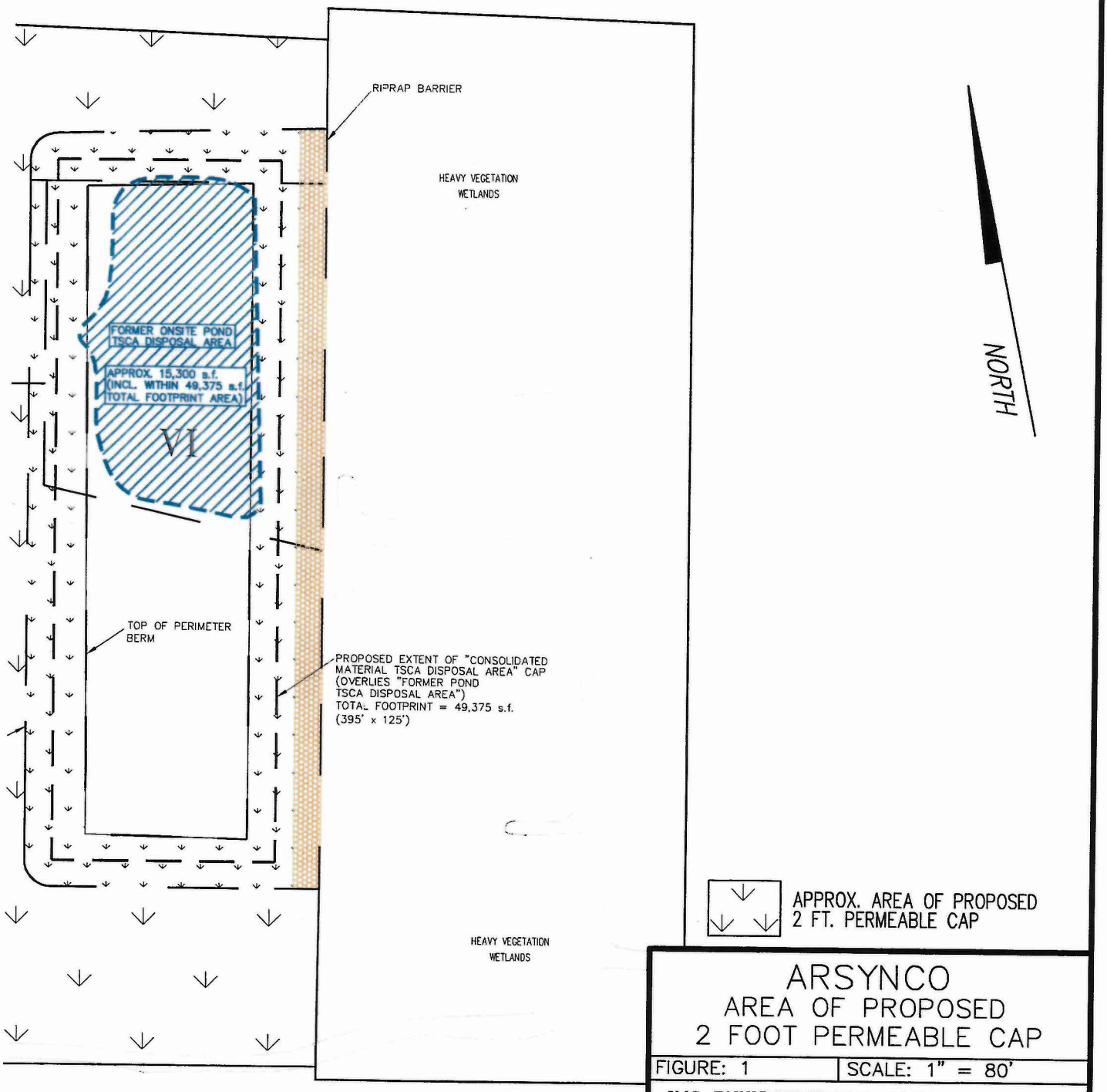
We appreciate your cooperation with regard to this matter. Should you have any questions or require additional information please feel free to give me a call at your earliest convenience

Very truly yours,

James M. Clabby
President, LSRP

enclosures

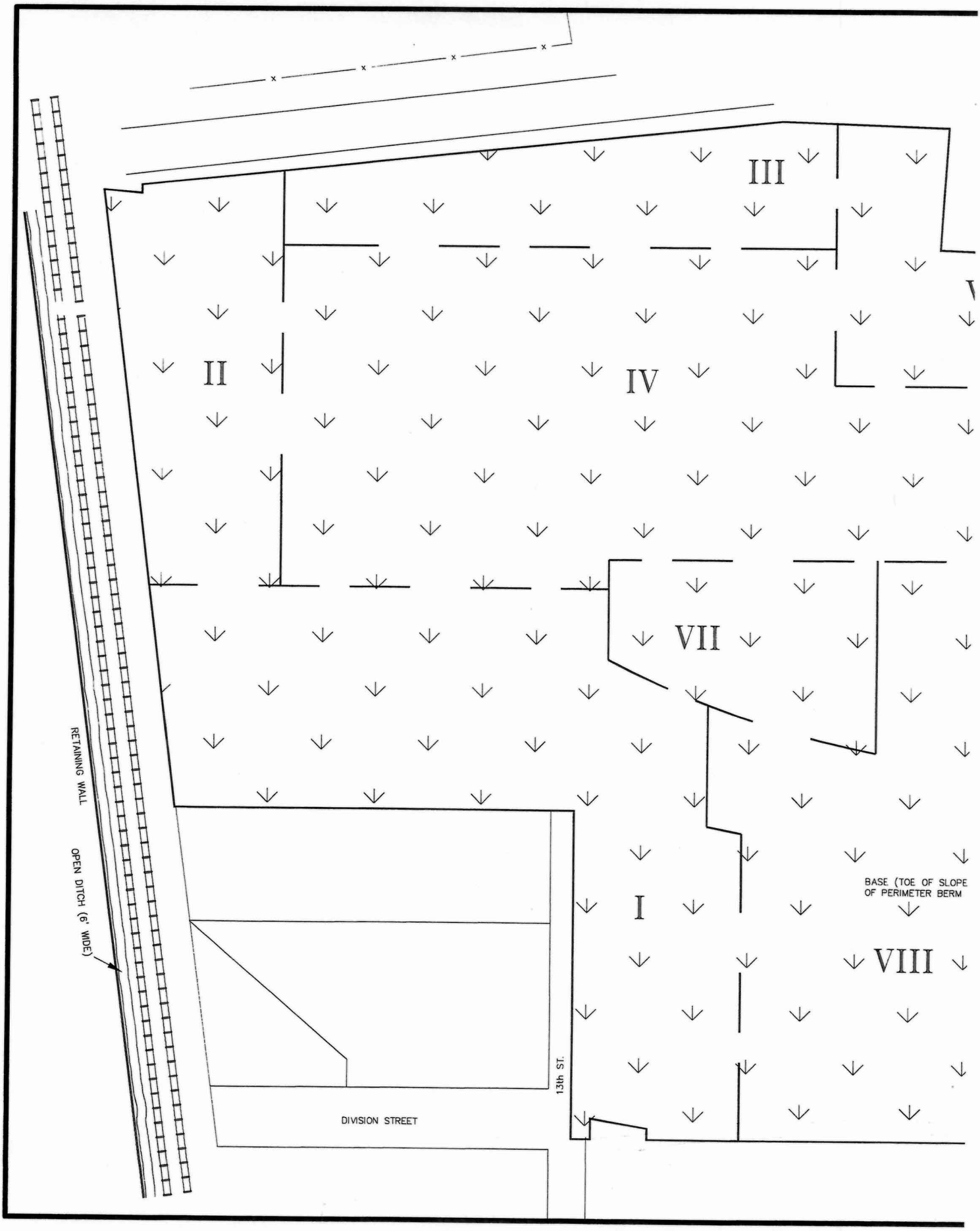
cc: Sameh Abdellatif, EPA



ARSYNCO
AREA OF PROPOSED 2 FOOT PERMEABLE CAP

FIGURE: 1	SCALE: 1" = 80'

JMC ENVIRONMENTAL CONSULTANTS, INC.
2109 BRIDGE AVENUE, BLD. B
POINT PLEASANT, NEW JERSEY 08742


III
II
IV
VII
I
VIII
RETAINING WALL
OPEN DITCH (6' WIDE)
BASE (TOE OF SLOPE
OF PERIMETER BERM
13th ST.
DIVISION STREET

ATTACHMENT A

ENGINEERING REPORT

Storm Drainage Improvements
Former Arsynco Industrial Facility
13th Street, Carlstadt, New Jersey

Prepared For:

Arsynco, Inc.
c/o Aceto Corp.
4 Tri Harbor Court
Port Washington, NY 11050

Prepared by:

ELM Site Solutions, Inc.

Roland Norris, PE, PLS
Senior Engineer

Marc Leber, PE
Senior Engineer

July 14, 2014
Revision 1 – April 2, 2015

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APPENDICES

1.0 INTRODUCTION

1.1 Project Overview

An evaluation of existing and proposed stormwater drainage has been completed for the Arsynco Site in Carlstadt, New Jersey (hereinafter referred to as the 'Site'). This Stormwater Management (SWM) Report was developed in support of the Flood Hazard Area Individual Permit and Waterfront Development Permit applications for the proposed remediation and redevelopment of the former Arsynco Industrial Facility and is included as the Engineering Report component of those permit applications. The Site is being cleaned up under the New Jersey Department of Environmental Protection (NJDEP) Property Transfer Program. Please note that under the existing ISRA case for this Site NJDEP, SRP has required the property owner to either pipe or line the existing drainage ditch along a portion of the southern boundary so that the ditch is not open/exposed to contaminated fill material located on the Site.

The Site consists of Lot 1 in Block 91 in the Borough of Carlstadt, in Bergen County, New Jersey. The project has an associated Limit of Disturbance (LOD) of approximately 12.3 acres (Tract 1 = 9.5 acres and Tract 2 = 2.8 acres). The Site is currently owned by Arsynco, Inc. (Applicant). The property is a former wetland with tidal influences from tributaries of the Hackensack River. Improvements were made to the property beginning prior to the early 1900s which included placement of fill for the construction of manufacturing operations and infrastructure. A portion of the site currently contains wetlands.

Figure 1: Vicinity Map (Source: Bing Maps-2014)

1.2 Topographic Features of the Project Area

The project area consists of 12.3 acres northeast of the Route 17 interchange for Paterson Plank Road/Patterson Avenue at the intersection of Division Avenue and 13th Street. The limits of disturbance cover the entire property. The Site is surrounded by industrial facilities. Topographic features include a generally flat Site with approximately 2.8 acres of saline marsh containing manmade ditches along the east side of the property (Tract 2) and a manmade drainage ditch along a portion of the south side of the property. The manmade ditches are a part of the Berry's Creek system. The approximate center of the Site is located at 607,475 feet Easting and 729,546 feet Northing. The Site can be found on the Weehawken, New Jersey-New York, United States Geological Survey (USGS) 7.5-minute series quadrangle as shown in Appendix I. The Site falls within the HUC-14# 02030103180060 area of Hackensack-Passiac Watershed (HUC-8# 02030103).

1.3 Types, depths, and aerial extents of soils

The USDA Web Soil Survey (accessed July 7, 2014) shows the mapped area for the project area (Figure 3) as "Urban Land" (map unit "UR"). While this is not indicative of the native soil type of the Site, it does represent its industrial and mostly impervious location. With portions of the Site being capped with impermeable materials, hydrologic calculations will assume a soil type "D" (clay soils).

2.0 Hydrologic Model

Two simulations using the NRCS (SCS) TR-55 method were performed to calculate the rate of stormwater runoff for the existing and post-construction conditions. The simulations were used to establish a baseline, by assessing the change in hydrology produced from the 2-, 10, and 100-year, 24-hour storm events on the Site, given the existing and proposed post-construction land use. Rainfall data for the design storms analyzed were obtained from the NRCS Engineering Field Handbook Part 650, New Jersey Supplement for Bergen County. The area simulated included the drainage areas for the Site. Drainage areas and runoff calculations from the project area are presented in Appendix II of this narrative. Hydrographs shown in Appendix II were generated using the computer modeling program *Hydraflow Hydrographs for AutoCAD 2015*.

A majority of the pre-construction land cover conditions were open space in fair condition, with a smaller portion (1.5 acres) covered with either asphalt or intact concrete building floor slabs within the last 5 years. Pre-construction open space is hydrologic soil group D with a Curve Number (CN) value of 84. The remaining 1.5 acres has a CN value of 98. A composite CN of 86 was computed to represent the mix of land cover types in the pre-construction condition.

The post-remediation land cover includes 1.2 acres of impervious surface on Tract 1 for the "Consolidated Material TSCA Disposal Area" (i.e., the "TSCA Cap Area") and 7.7 acres of a vegetated soil surface for the general "site cap" on Tract 1. The 1.2 acres has a CN value of 98 and the 7.7 acres has a CN value of 84. The remaining portion of Tract 1 (0.6 acres) will remain as open space in fair condition with a CN of 84. Tract 2 (2.8 acres) consists of the existing wetland area and was assumed to also remain as open space in fair condition with a CN of 84. A composite CN of 85 was computed to represent the mix of land cover types in the post-construction condition.

Based upon the hydrologic analysis, the proposed site work results in a slight decrease in stormwater runoff. Refer to Appendix II for additional information.

The values used to calculate the discharges are as follows:

Drainage Area	12.3 acres
Curve Number (CN) for existing conditions	86
Curve Number (CN) for proposed conditions	85
Existing Time of Concentration (T_c)	20.9 minutes
Proposed Time of Concentration (T_c)	20.8 minutes

The existing and proposed discharges as computed using the above mentioned methods are as follows:

	Peak Discharge (Q)		
	2-YR, 24-HR (*cfs*)	10-YR, 24-HR (*cfs*)	100-YR, 24-HR (*cfs*)
Existing Conditions	18.47	33.75	62.11
Proposed Conditions	17.71	32.93	61.28
Percent Change	-4.1%	-2.4%	-1.3%

The discharges from the proposed post-conditions are smaller due to the proposed change in land cover. As noted above, detailed Curve Number and Peak Flow calculations are provided in Appendix II.

3.0 Non-structural Stormwater Management Strategies

A stormwater management system is not proposed on the Site to reduce peak flow runoff or groundwater recharge. However, non-structural management strategies per N.J.A.C. 7:8-5.3 are proposed to be implemented on the Site. These include improving an existing irregular manmade ditch to provide positive drainage to the discharge point rather than using hard infrastructure (e.g., culvert) as a replacement. In addition, per N.J.A.C. 7:8-5.3(b)9.iii, the proposed TSCA berm will prevent accumulations of pollutants from leaving the Site.

4.0 Groundwater Recharge Compliance

Per N.J.A.C 7:8-5.4(a)2.iii, the groundwater recharge requirement stated in N.J.A.C 7:8-5.4 is not applicable to this site. Contaminated groundwater is well documented on the Site and recharge would be inconsistent with the remedial action taking place.

5.0 Water Quality Compliance

Per N.J.A.C. 7:8-5.5(a), water quality measures are required where proposed pavement is subject to vehicular traffic, which is not a proposed condition on the Site.

6.0 Flood Hazard Area Control Act Compliance

Applicable sections of N.J.A.C. 7:13 include 10.1 through 10.7 and 11.1 through 11.3. Design considerations and requirements of these sections have been met when preparing the attached design drawings. No endangered species or acidic soils have been documented at the site. No significant or adverse effects will be caused on the items listed in Section 11.1 by the regulated

activity. Specific details of N.J.A.C. 7:13 can be found in the following report: *Application and Environmental Report for Flood Hazard Area (FHA) Individual Permit*, Former Arsynco Facility Site, Block 91, Lot 1, Carlstadt Borough, Bergen County, New Jersey.

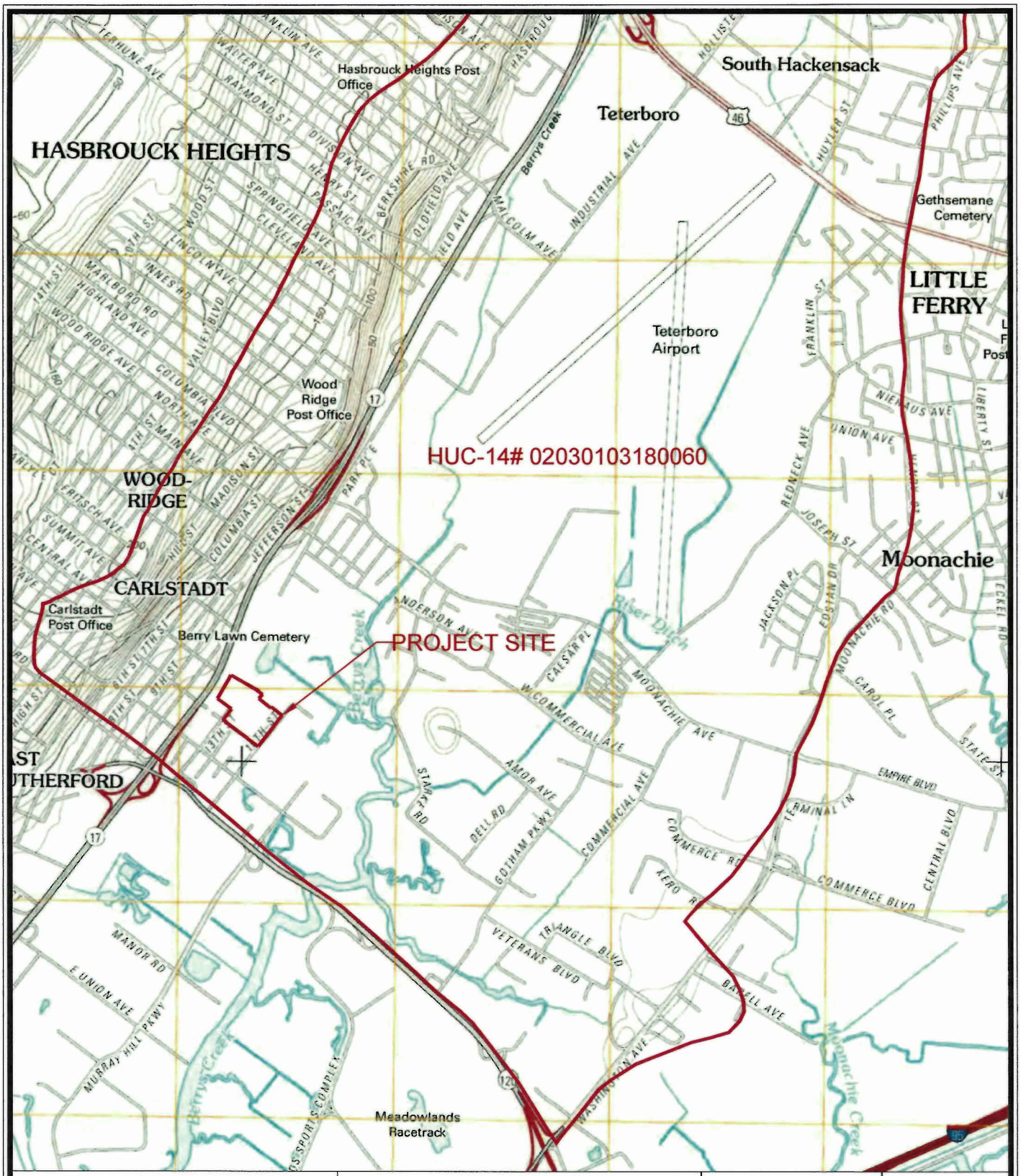
7.0 Supporting Calculations

Worksheets documenting supporting calculations are provided in Appendix II.

8.0 Plan Drawings

The locations and extent of proposed plans are shown on the attached design drawings.

APPENDIX I: Site Information



USGS TOPOGRAPHIC SURVEY
WEEHAWKEN QUADRANGLE
NEW JERSEY-NEW YORK
7.5-MINUTE SERIES

ARSYNCO, INC

USGS MAP

SITE LOCATION:
13TH STREET
CARLSTADT, NEW JERSEY

DRAWN BY: BMT
CHECK BY: ML

DATE:
JULY 7, 2014

SCALE:
1"=2000'

SHEET:
EXHIBIT-1

EXHIBIT B: FEMA FIRM MAP

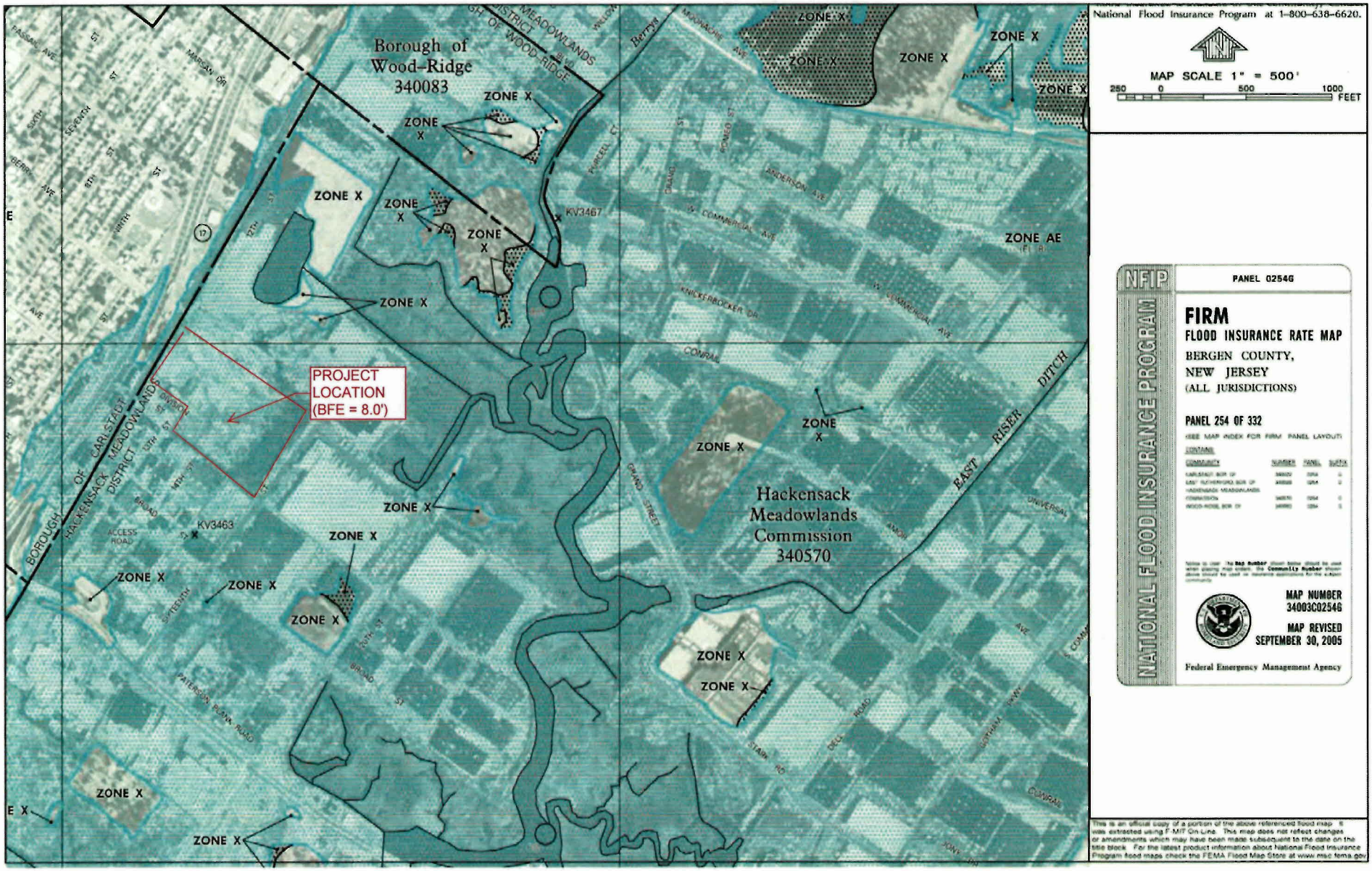
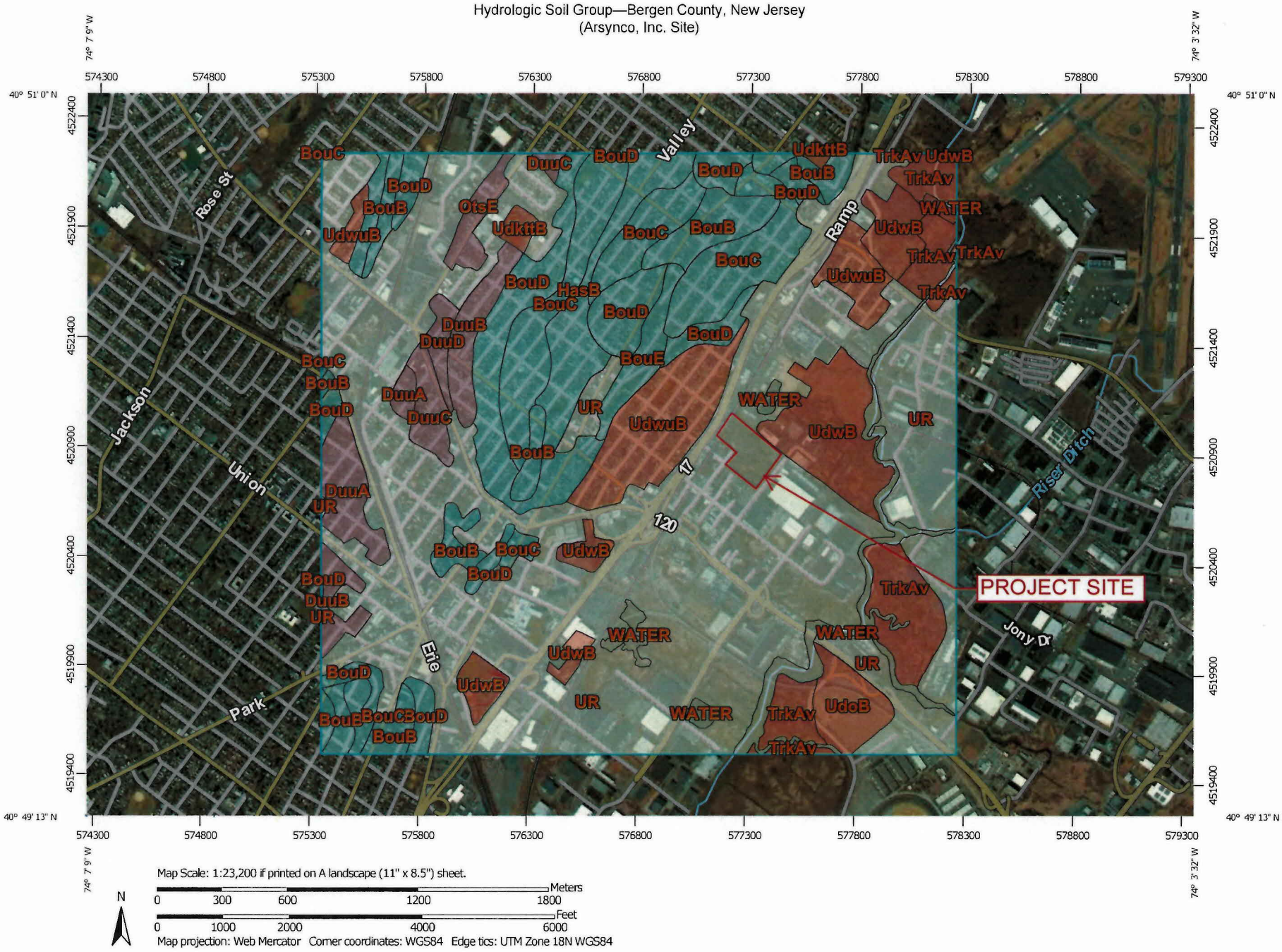


EXHIBIT C: NRCS SOILS MAP



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Bergen County, New Jersey
Survey Area Data: Version 10, Nov 26, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 26, 2011—Jun 16, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Bergen County, New Jersey (NJ003)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BouB	Boonton-Urban land complex, 0 to 8 percent slopes	C	84.7	4.3%
BouC	Boonton-Urban land complex, 8 to 15 percent slopes	C	143.6	7.2%
BouD	Boonton-Urban land complex, 15 to 25 percent slopes	C	159.9	8.1%
BouE	Boonton-Urban land complex, 25 to 45 percent slopes	C	19.8	1.0%
DuuA	Dunellen-Urban land complex, 0 to 3 percent slopes	A	33.0	1.7%
DuuB	Dunellen-Urban land complex, 3 to 8 percent slopes	A	36.9	1.9%
DuuC	Dunellen-Urban land complex, 8 to 15 percent slopes	A	19.3	1.0%
DuuD	Dunellen-Urban land complex, 15 to 25 percent slopes	A	9.7	0.5%
HasB	Haledon-Urban land complex, 3 to 8 percent slopes	C	49.5	2.5%
OtsE	Otisville gravelly loamy sand, 25 to 35 percent slopes	A	14.4	0.7%
TrkAv	Transquaking mucky peat, 0 to 1 percent slopes, very frequently flooded	D	86.2	4.3%
UdkttB	Udorthents, loamy, 0 to 8 percent slopes, frequently flooded	D	7.2	0.4%
UdoB	Udorthents, organic substratum, 0 to 8 percent slopes	D	27.9	1.4%
UdwB	Udorthents, wet substratum, 0 to 8 percent slopes	D	106.2	5.4%
UdwuB	Udorthents, wet substratum-Urban land complex	D	94.9	4.8%

Hydrologic Soil Group— Summary by Map Unit — Bergen County, New Jersey (NJ003)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
UR	Urban land		1,038.4	52.4%
WATER	Water		50.0	2.5%
Totals for Area of Interest			**1,981.5**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

APPENDIX II: Hydrologic Analysis: Peak Flow Calculations

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Legend

Hyd.	Origin	Description
1	SCS Runoff	Exist. Conditions
2	SCS Runoff	Prop. Conditions

TR55 Tc Worksheet

Hyd. No. 1

Exist. Conditions

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.30		0.00		0.00		
Land slope (%)	= 1.40		0.00		0.00		
Travel Time (min)	**= 11.13**	**+**	**0.00**	**+**	**0.00**	**=**	**11.13**
Shallow Concentrated Flow							
Flow length (ft)	= 843.00		0.00		0.00		
Watercourse slope (%)	= 0.81		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.45		0.00		0.00		
Travel Time (min)	**= 9.68**	**+**	**0.00**	**+**	**0.00**	**=**	**9.68**
Channel Flow							
X sectional flow area (sqft)	= 95.00		0.00		0.00		
Wetted perimeter (ft)	= 38.00		0.00		0.00		
Channel slope (%)	= 1.50		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=11.24						
			0.00				
					0.00		
Flow length (ft)	({0})93.0		0.0		0.0		
Travel Time (min)	**= 0.14**	**+**	**0.00**	**+**	**0.00**	**=**	**0.14**

Total Travel Time, Tc ..... 20.90 min

TR55 Tc Worksheet

Hyd. No. 2

Prop. Conditions

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.30		0.00		0.00		
Land slope (%)	= 1.50		0.00		0.00		
Travel Time (min)	**= 10.83**	**+**	**0.00**	**+**	**0.00**	**=**	**10.83**
Shallow Concentrated Flow							
Flow length (ft)	= 850.00		0.00		0.00		
Watercourse slope (%)	= 0.79		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.43		0.00		0.00		
Travel Time (min)	**= 9.88**	**+**	**0.00**	**+**	**0.00**	**=**	**9.88**
Channel Flow							
X sectional flow area (sqft)	= 95.00		0.00		0.00		
Wetted perimeter (ft)	= 38.00		0.00		0.00		
Channel slope (%)	= 1.50		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=11.24						
			0.00				
					0.00		
Flow length (ft)	({0})93.0		0.0		0.0		
Travel Time (min)	**= 0.14**	**+**	**0.00**	**+**	**0.00**	**=**	**0.14**

Total Travel Time, Tc ..... **20.80 min**

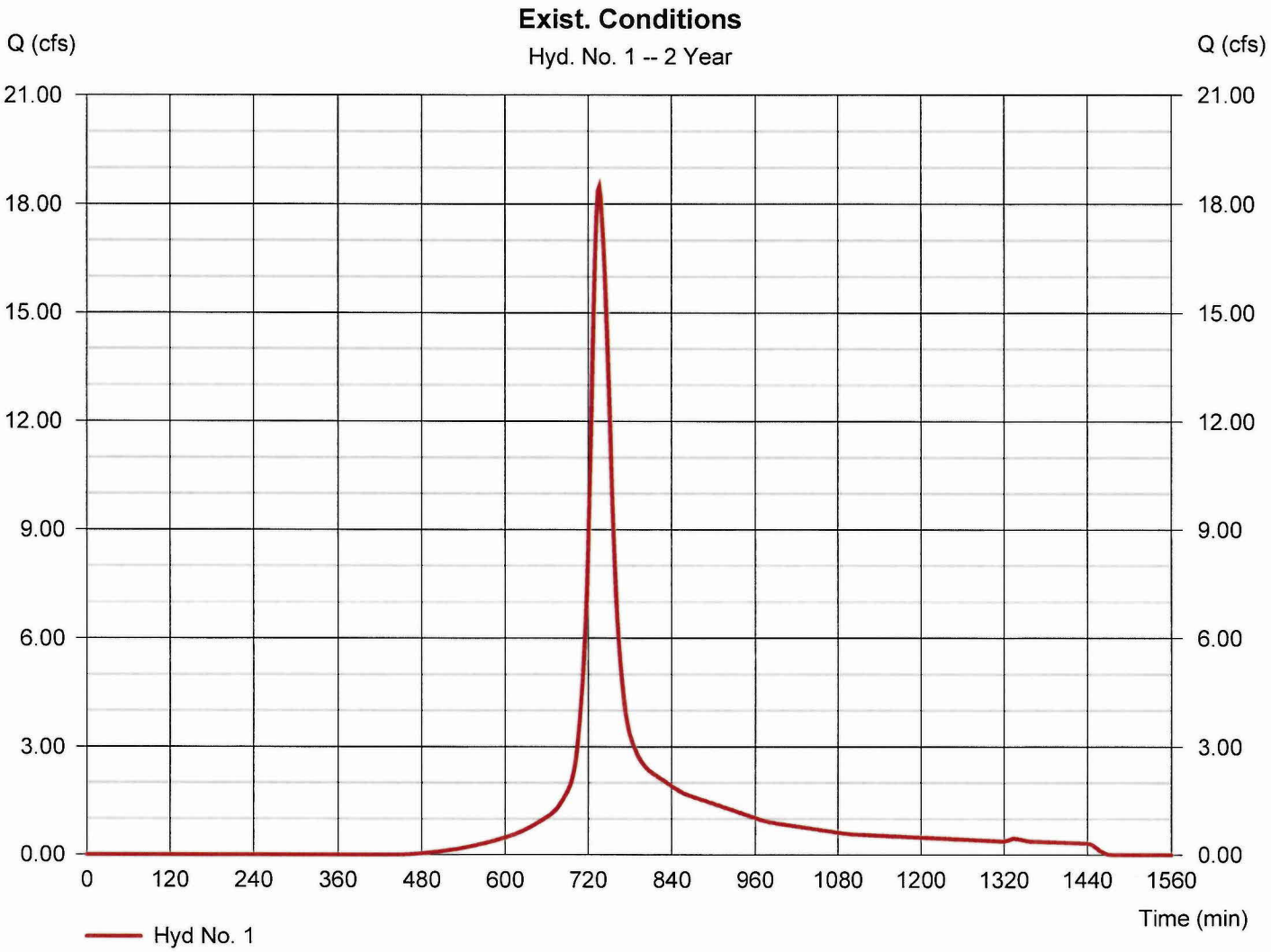
Hydrograph Report

Hyd. No. 1

Exist. Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 18.47 cfs
Storm frequency	= 2 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 87,363 cuft
Drainage area	= 12.300 ac	Curve number	= 86*
Basin Slope	= 0.9 %	Hydraulic length	= 1036 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.90 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.500 x 98) + (10.800 x 84)] / 12.300



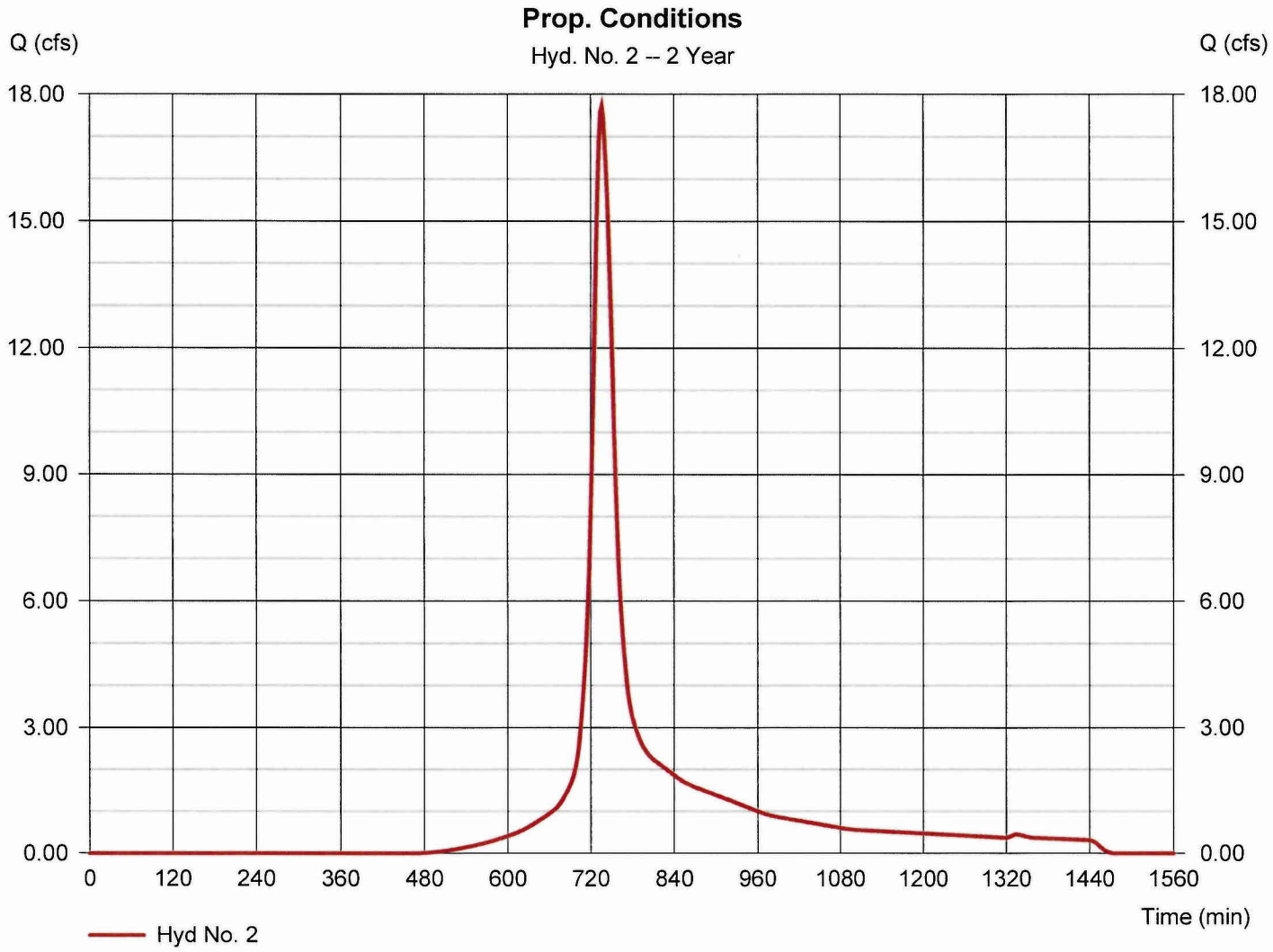
Hydrograph Report

Hyd. No. 2

Prop. Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 17.71 cfs
Storm frequency	= 2 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 83,771 cuft
Drainage area	= 12.300 ac	Curve number	= 85*
Basin Slope	= 0.9 %	Hydraulic length	= 1043 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.80 min
Total precip.	= 3.30 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.200 x 98) + (11.100 x 84)] / 12.300



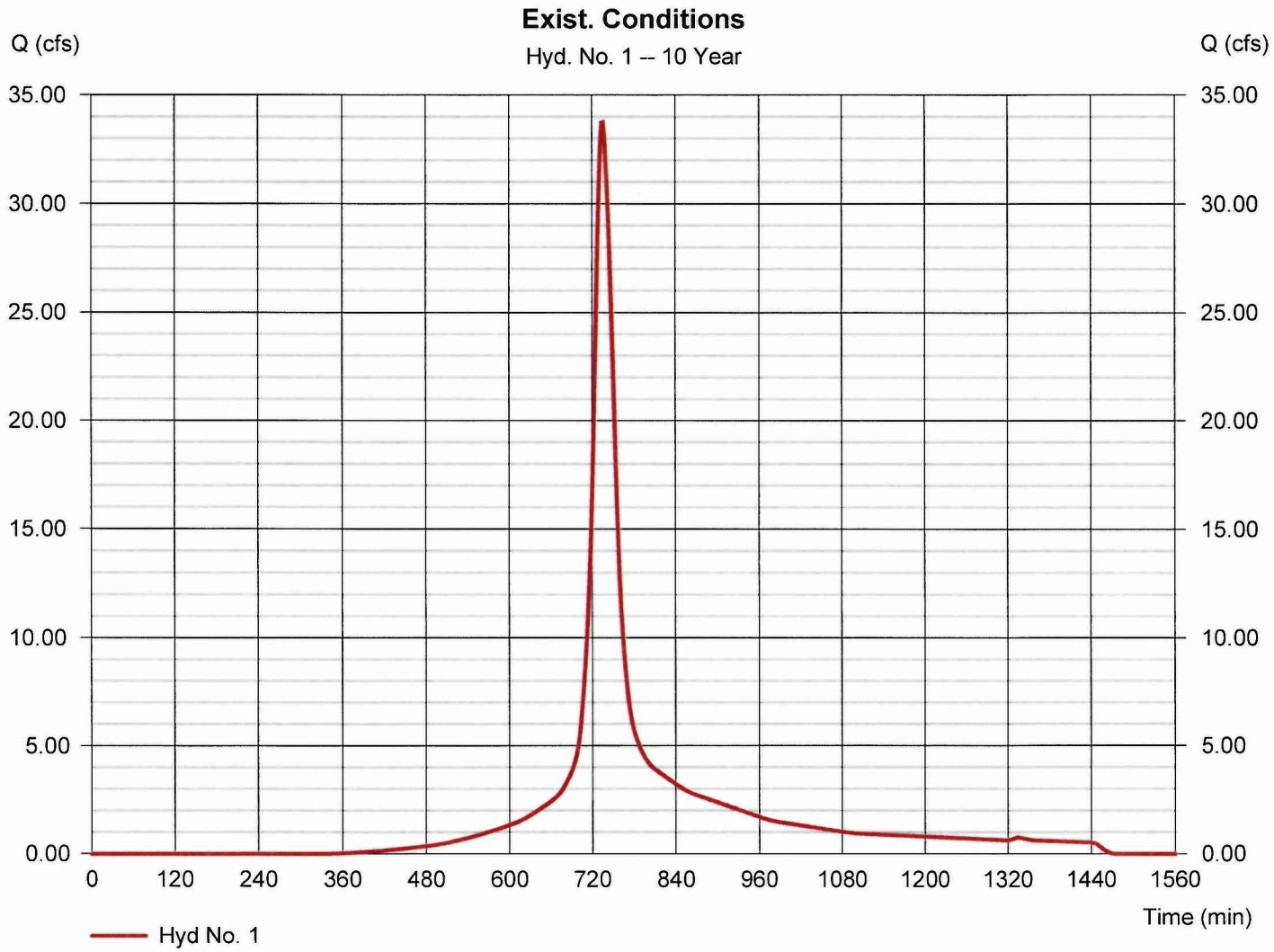
Hydrograph Report

Hyd. No. 1

Exist. Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 33.75 cfs
Storm frequency	= 10 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 161,809 cuft
Drainage area	= 12.300 ac	Curve number	= 86*
Basin Slope	= 0.9 %	Hydraulic length	= 1036 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.90 min
Total precip.	= 5.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.500 x 98) + (10.800 x 84)] / 12.300



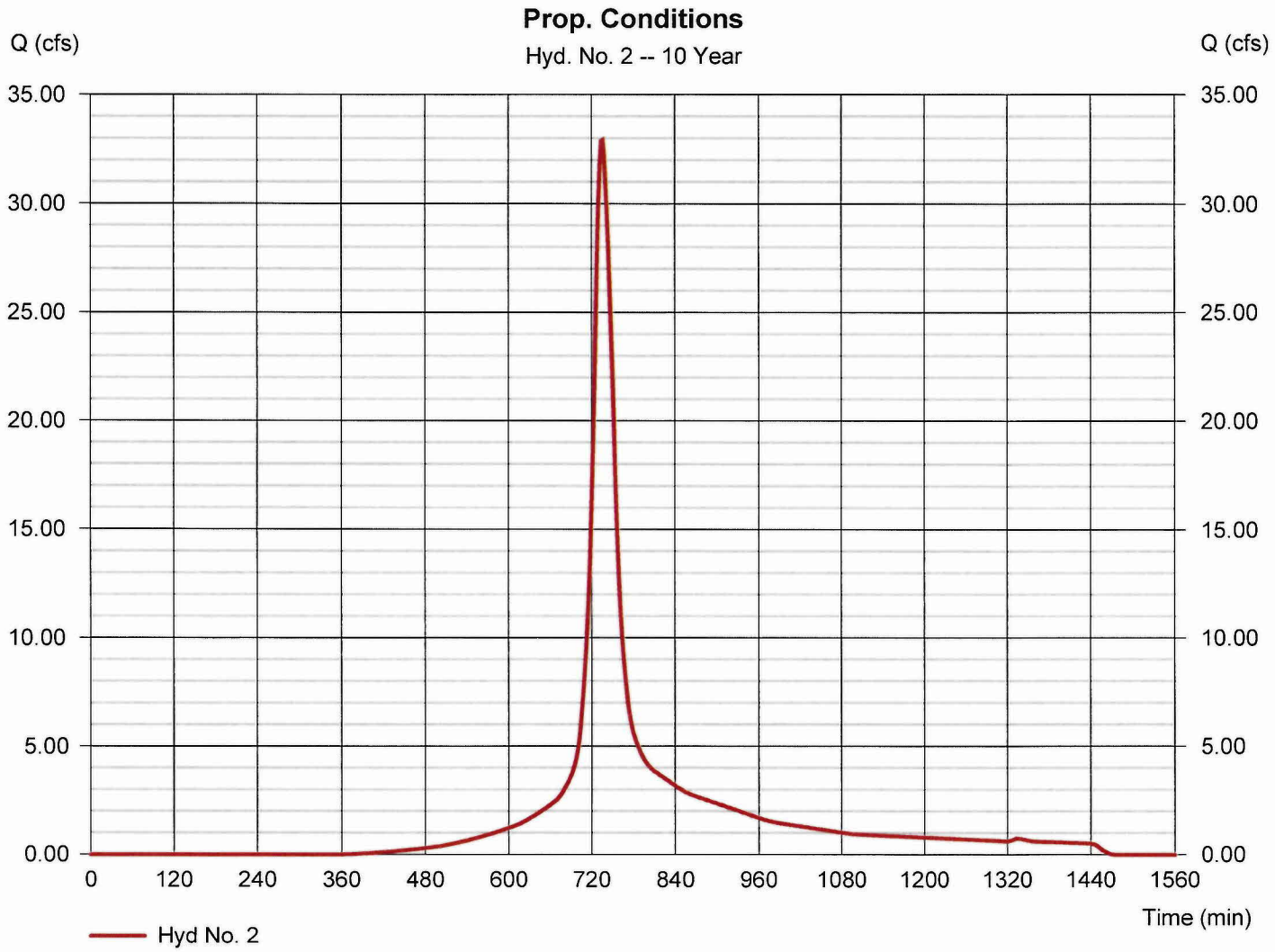
Hydrograph Report

Hyd. No. 2

Prop. Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 32.93 cfs
Storm frequency	= 10 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 157,271 cuft
Drainage area	= 12.300 ac	Curve number	= 85*
Basin Slope	= 0.9 %	Hydraulic length	= 1043 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.80 min
Total precip.	= 5.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.200 x 98) + (11.100 x 84)] / 12.300



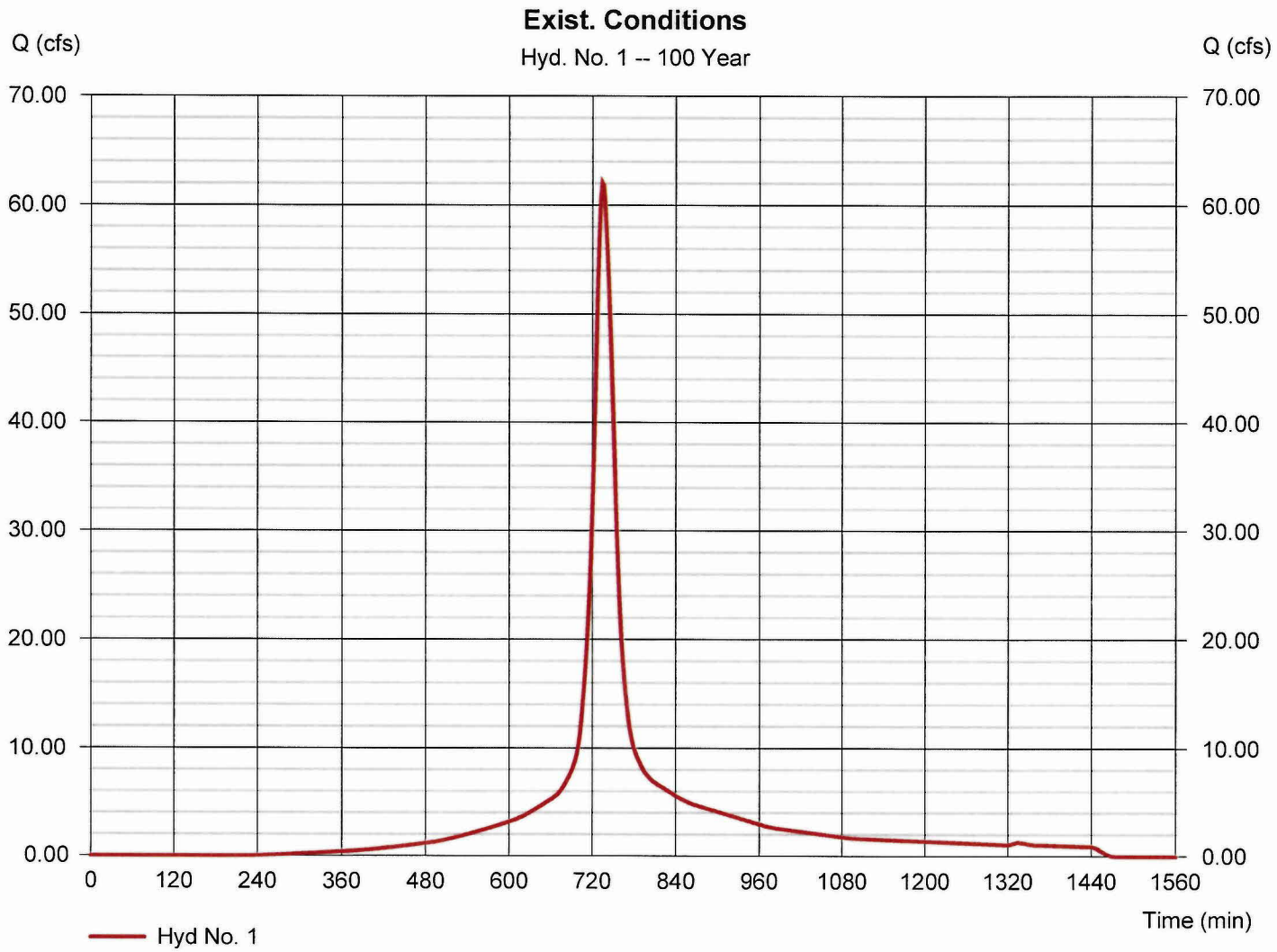
Hydrograph Report

Hyd. No. 1

Exist. Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 62.11 cfs
Storm frequency	= 100 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 305,383 cuft
Drainage area	= 12.300 ac	Curve number	= 86*
Basin Slope	= 0.9 %	Hydraulic length	= 1036 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.90 min
Total precip.	= 8.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.500 x 98) + (10.800 x 84)] / 12.300



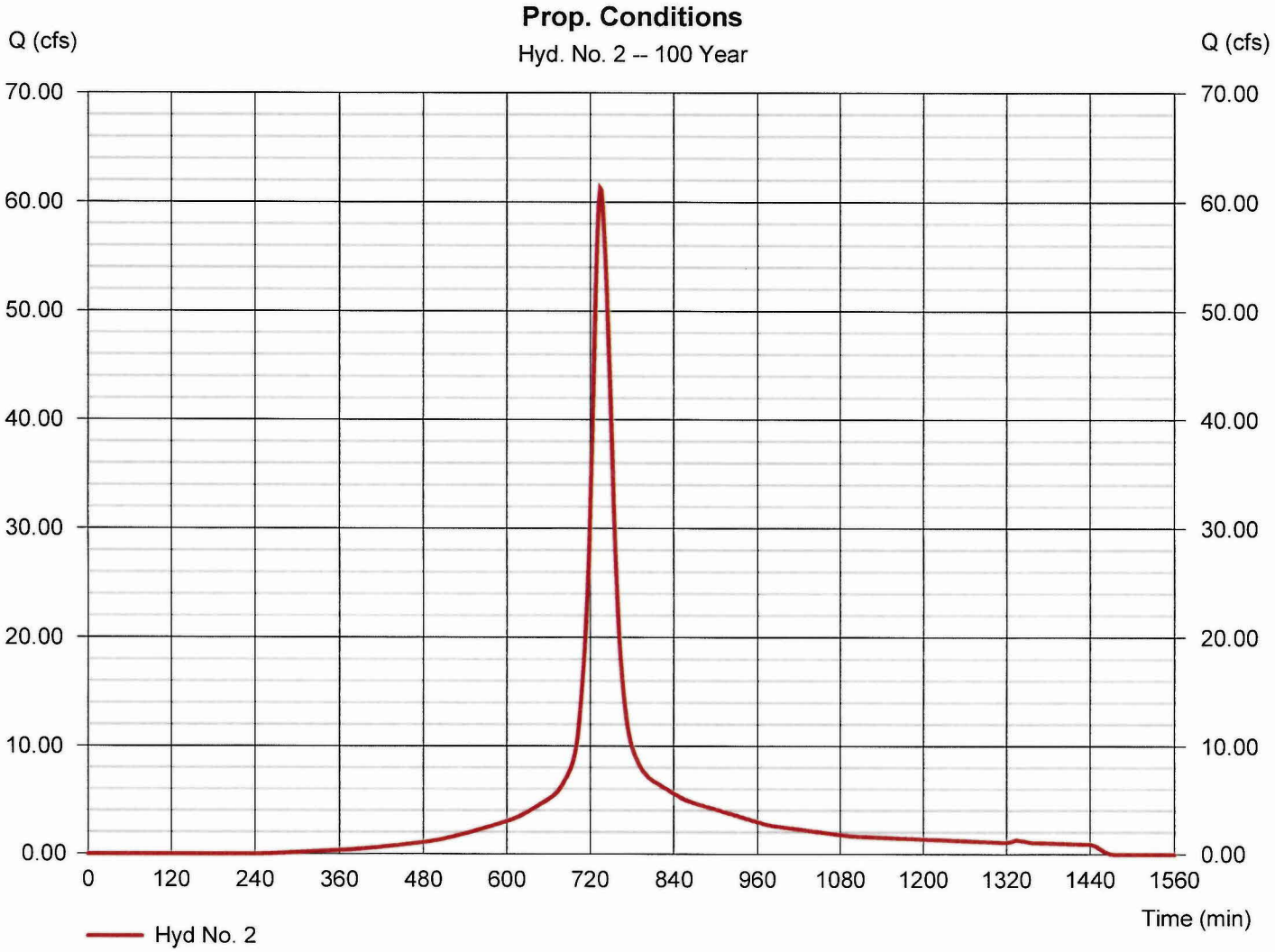
Hydrograph Report

Hyd. No. 2

Prop. Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 61.28 cfs
Storm frequency	= 100 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 299,934 cuft
Drainage area	= 12.300 ac	Curve number	= 85*
Basin Slope	= 0.9 %	Hydraulic length	= 1043 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.80 min
Total precip.	= 8.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.200 x 98) + (11.100 x 84)] / 12.300



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	62.1764	12.7000	0.8901	--------
2	68.6780	12.6000	0.8716	--------
3	0.0000	0.0000	0.0000	--------
5	68.4695	12.4000	0.8251	--------
10	71.4662	12.4000	0.8035	--------
25	61.4591	11.0000	0.7384	--------
50	57.9261	10.4000	0.7031	--------
100	50.2401	9.0000	0.6526	--------

IDF data not used in computations. Qs based off of Rainfall Precipitation below

File name: (NC)Raleigh-Table2-3.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	4.82	3.86	3.23	2.79	2.46	2.20	1.99	1.82	1.68	1.56	1.46	1.37
2	5.64	4.54	3.81	3.30	2.91	2.61	2.37	2.17	2.01	1.87	1.75	1.64
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.49	5.27	4.46	3.88	3.45	3.11	2.84	2.61	2.42	2.26	2.12	2.00
10	7.20	5.88	5.00	4.37	3.89	3.52	3.22	2.97	2.76	2.58	2.43	2.29
25	7.93	6.49	5.54	4.87	4.36	3.96	3.64	3.37	3.15	2.95	2.79	2.64
50	8.47	6.95	5.96	5.25	4.72	4.30	3.96	3.68	3.44	3.24	3.06	2.91
100	8.98	7.35	6.31	5.58	5.03	4.60	4.25	3.96	3.72	3.51	3.33	3.17

Tc = time in minutes. Values may exceed 60.

Precip. file name: J:\Design\Stormwater\PCP\BergenCountyNJ.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.80	3.30	0.00	4.30	5.10	6.30	7.30	8.40
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00